

Systems fundamentals

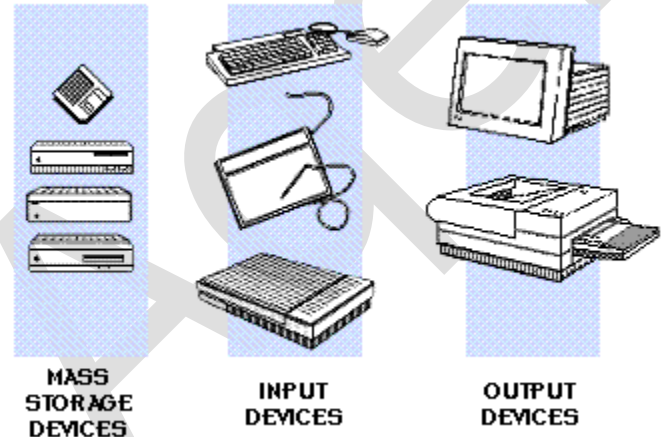
Hardware is the parts of the computer that you can kick and pick up!

All PCs have need the same basic hardware in order to function, such as CPU, storage, input and output devices and RAM.

Knowledge of Technology

Key terms

- data, information,
 - hardware components, for example, input devices, output devices,
 - processing, MHz,
 - storage, memory (RAM, ROM),
 - dpi,
 - bit, KB, MB, GB, TB,
 - ASCII,
 - compatibility,
 - OMR, OCR,
 - bar code ,
 - baud,
 - verification and validation, can also mean authentication (verification) of users to applications, for example, smart card login and client validation through SSL.
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- encryption/decryption,
 - firewall
 - virus, Trojan horse , worm,
 - logic bomb,
 - platform, What platorms are in your organisation.
 - peripheral
 - *Use, advantages and disadvantages* of analogue and digital data.
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- *Operating systems* (multitasking, boot) and utilities, for example, defragment, disk format, virus scan programs
 - *Responsible computer use* (for example, regular back-ups, virus checking, security, storage, housekeeping)



- *A responsible and systematic* approach to implementing or upgrading IT systems, for example, analysis, design, implementation, testing, evaluation, training, policies and standards.

Social and ethical issues

Students must study and evaluate the social and ethical issues involved in the use of IT systems. These may include:

- The economic value of information
- Environmental issues related to the production of computer components and supplies
- Environmental issues related to the disposal of obsolete hardware and computer supplies
- Health issues and ergonomics related to the use of hardware
- Password protection, security, biometrics and authorized access
- Issues related to viruses on both stand-alone and network systems
- Greater dependence of organizations on IT
- Increase in teleworking and the virtual office
- The need for ongoing training and retraining
- The economic and psychological implications of planned IT obsolescence in hardware, software and services, which has been forced on consumers by the IT industry
- Organizational policies and standards, for example, e-mail, surveillance and monitoring policies.

References

Bulleted headings excerpted from Information technology in a global society: guide. Cardiff Wales, UK: International Baccalaureate Organization, 2006.

DATA INFORMATION

Data and information

What is the difference between **data** and **information**?

Data

Data is the collection of any facts, from which can be made a conclusion. Data in the computer world: "URL is a kind of URL that allows inclusion of small data items as "immediate" data, as if it had been included externally. The URLs allow content creators to embed small files inline HTML documents, without complicated, document level formatting, like using MIME and cid: or mid:. It is an IETF standard."

Information

Information is a received and understood message. Also it is the collection of data from which a person can make conclusions. Information is the result of processing, manipulating and organizing data in a way that adds to the knowledge of the person receiving it.

Both information and data can be obtained from many different sources, such as books, orally from another person, from the internet, news, etc. People are obtaining information every day, all the time. Without information and data, people wouldn't be able to think or increase their knowledge about specific things. The humans' brain needs data to process. After processing them and the person understand them, that become information which can the person use later on.

Ever wondered how the brain works? <http://health.howstuffworks.com/brain.htm>

INPUT DEVICES

Input Devices are the devices that feed the data into the computer.

Here are some of the devices that are commonly used in a PC:



Pointing devices such as:

- Computer mouse – a primary device used for the navigation and interaction with the computer. Some mice are optical (include the lens) , laser (very high definition and precision, designed mostly for gamers and demanding customers) , and mechanical (use a track ball that is located inside the mouse)
- Trackballs - a pointing device consisting of a ball housed in a socket containing sensors to detect rotation of the ball about two axes. (often used in a computer terminals at airports , and usually in many military cases (such as submarines and sonar equipment)
- Light pens - are computer input devices in the form of a light-sensitive wand used in conjunction with the computer's CRT monitor. It allows the user to point to displayed objects, or draw on the screen, in a similar way to a touch screen but with greater positional accuracy. A light pen can work with any CRT-based monitor, but not with LCD screens, projectors or other display devices.
- Touch Pad - A touchpad is an input device commonly used in laptop computers. They are used to move the cursor, using motions of the user's finger. They are a substitute for a computer mouse. Touchpads vary in size but are rarely made larger than 20 square centimeters (about 3 square inches). They can also be found in PDAs.

Keyboard devices:

- Keyboard – a primary device for entering information into the computer. Often includes a standard keyboard for COM ports and a newer type with an USB support.

Gaming devices:

- Joystick - A joystick is a personal computer peripheral or general control device consisting of a handheld stick that pivots about one end and transmits its angle in two or three dimensions to a computer.
- Game pad
- Power pad
- Analog stick

Image and video input devices:

- Web cam
- Digital Scanner
- Image Scanner

OUTPUT DEVICES

What is an Output Device?

An output device is any physical device used by a computer to present understandable data to the user. These output devices can be audio, visual, or mechanical.

Examples of output devices

- **Visual Display Units (VDU) or monitors:** Monitors or VDUs are used to display text or graphics to a user via a screen.
- **Printer:** A printer prints out the information that is on the computer onto paper. You then possess a 'hard copy' of the information you just printed.

There are two main types of **printers**:

- ❖ **Impact**
- ❖ **Non-impact**
- **Speaker:** A speaker gives out the sound from a computer. Speakers can either be built into the computer, or they can come separately and must be attached to the computer for them to function
- **Headphones:** Much like a speaker, headphones give out the sound from the computer. Unlike speakers though, they are worn over one's ears so they may only be used by one person at a time.
- **LCD Projector:** An LCD projector is an electronic device used for displaying the computer screen on a much larger projection screen. The projector can display videos, graphics and text. Another type of projector includes, Video projector.
- **Plotter:** Plotters are used to draw/create graphs and diagrams.

There are two main types of plotters:

- ❖ **Pen plotters**
- ❖ **Electrostatic plotters**



M HZ

What is a MHz

MHz (1 million Hz) is the abbreviation for megahertz. One MHz represents one million cycles per second. *"A cycle per second is the number of times an alternating circuit reaches both minimum and maximum values in one second"* ([Wind Power Terms Glossary](#)). So, for example, if a computer runs at 400 MHz, then it performs 400 million cycles per second.

The computer's internal bus plays a large roll in controlling the speed of the computer. The bus of the computer is, *"a subsystem that transfers data or power between computer components inside a computer"* ([wikipedia](#)). The speed of the bus is measured in MHz – it is also called the 'clock speed.' The faster the speed of the bus, the faster data can be sent out along all of the components of the computer.

DPI

What is dpi?

DPI-dots per inch, is the resolution measurement for printers. Often it is inappropriately used as a resolution for digital cameras (pixels) and monitors(pixels). The more dots per inch are done by the printer, the sharper an image is. In the case of monitors, DPI refers to the number of pixels present per inch of display screen. The technically correct term is **PPI** or pixels per inch, but DPI is commonly used instead.

What do I need to be able to print in high DPI?

The higher the DPI is, the longer will it take to print. To be able to print in high DPI, you will need a bigger memory and a faster processor. The modern printers have the opportunity to switch between different DPI's. The lower DPI will take shorter time to print and it will use less printing color. The most commonly used DPI is 600-1800 DPI. The picture we see on a computer screen will not be as sharp on a printed copy due to limitations of available ink colors in the printer.



BIT KBMBGBTB

What is a Bit?

Computers operate using a base-2 number system, also called the binary number system. These two numbers are '0' and '1', which represent the electrical values of off or on (where 0 represents off and 1 represents on). A bit is a digit in the binary system that consists of these two numbers. So, for example, the number 10110100 is 8 bits long. It is the

smallest value of data on a computer but they are usually gathered into groups of eight to form a byte.

What is a KB?

KB stands for **kilobyte** which is equivalent to: 1,024 bytes

What is a MB?

MB stands for **megabyte** which is equivalent to: 1,048,576 bytes

What is a GB?

GB stands for **gigabyte** which is equivalent to: 1,073,741,824 bytes

What is a TB?

TB stands for **terabyte** which is equivalent to: 1,099,511,627,776 bytes

Look for **Petabyte Pb- Exabyte Eb- Zettabyte Zb- Yottabyte Yb**

ASCII

ASCII stands for (American Standard Code for Information Interchange) and is a special type of encoding language based on the English alphabet. ASCII codes represent text in computers, communications equipment, and other devices that work with text. Most modern character encodings — which support many more characters — have a historical basis in ASCII.

COMPATIBILITY

Computer compatibility is the ability of a system to accept input intended for later versions of itself. In other words, it is the ability of the computer to adjust to changes in software. For example if there is a new version of iTunes available, the programmers have to make sure it will be "compatible" with the latest version of both Windows and Macs.

Compatibility is harder to achieve than backward compatibility because it needs to cope gracefully with an unknown future data format or requests for unknown future features. Backward compatibility does not have this issue as it accepts a known data format.

An example of forward compatibility is when the specification tells a web browser to ignore those HTML tags which it does not recognize. It is typical for forward compatible systems to ignore obsolete data or application instructions.

Software applications attempting to provide backward compatibility with older operating system versions must pay close attention to the software logic used in responding to the identified operating system.

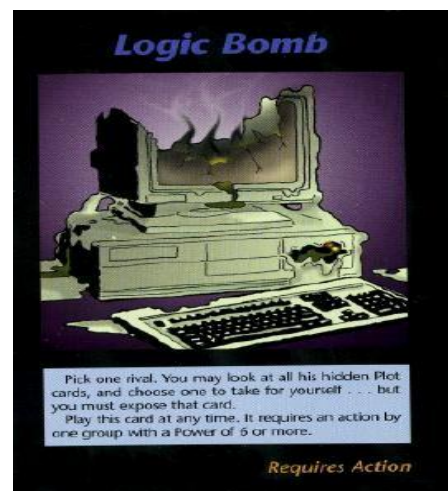
TROJAN HORSE

A Trojan Horse is a malicious software or program similar to a virus. The difference however is that for it to work, it requires the help of the intended victim through some form of an action. Trojan horses are masked as harmless programs, or as useful ones, so that the intended recipient will comply and run or install the program or software. Once that is done, the Trojan Horse can execute whatever malicious work it has been sent out to do. This can be done in two ways: the malicious computer code can be embedded in a useful program that has been corrupted by hacker, or it can be a program that works on its own and pretends to be harmless. Due to this deception, people will invite this software or program into their computer system and thus will be negatively affected.



LOGIC BOMB

A logic bomb can easily be compared to a bomb that has a timer, or may be pressure sensitive. In the IT world, it is a program, or piece of a program that remains dormant until it receives a certain signal, or stops receiving that signal. What this means is that someone can use a logic bomb with a certain software, and use it as a personal security measure. They program the logic bomb to look for a signal from a website, wait for a certain date, or even wait for a server size to reach a certain limit, and then it will execute its orders. The orders can be anything from erasing software to erasing everything on the computer or network. The main idea behind a logic bomb is that it does not need direct orders to carry out whatever it is intended to do, it instead is used as an "if" tool. If a certain thing happens, then the logic bomb goes off.



ANALOGUE AND DIGITAL DATA

What is the difference between analog and digital data?

"Analogue signals use continuously variable electric currents and voltages to reproduce data being transmitted. Since data is sent using variable currents in an analog system, it is very difficult to remove noise and wave distortions during the transmission. For this reason, analogue signals cannot perform high-quality data transmission.



On the other hand, digital signals use binary data strings (0 and 1) to reproduce data being transmitted. Noise and distortions have little effect, making high-quality data transmission possible. INS-Net's high-quality digital data transmission at high speeds is especially beneficial for transmission using computers since computers themselves utilize digital signals for information processing."

For those of you who are interested in knowing more about the difference between analog and digital data, here is a useful link: [NTT Company](#).

An example of a machine using analogue data is a seismometer or sound level meter. Analog players or recorder work with a continuous stream of information. Digital devices use one's and zero's. Most information today is stored digitally, because computers work with digital signals, but if you need to convert analog data to digital, don't worry, there is such a way of doing so using a (DAC) Digital to Analogue converter. The analog wave produced by the DAC is amplified and fed to the speakers to produce the sound.



Digital Data are data that are electromagnetically stored in the form of discrete digits (**0 and 1**). We can store digital data on devices such as CD's, DVD's, flash discs or hard drives. Analogue data can be change to digital data through a modem.

Each digital and analog data have their advantage and disadvantage:

Digital data are very easy to reproduce without losing quality and they can be stored on small devices such as flash discs, therefore they are more portable than analog data. Also TV signal changed from analog to digital signal lately.

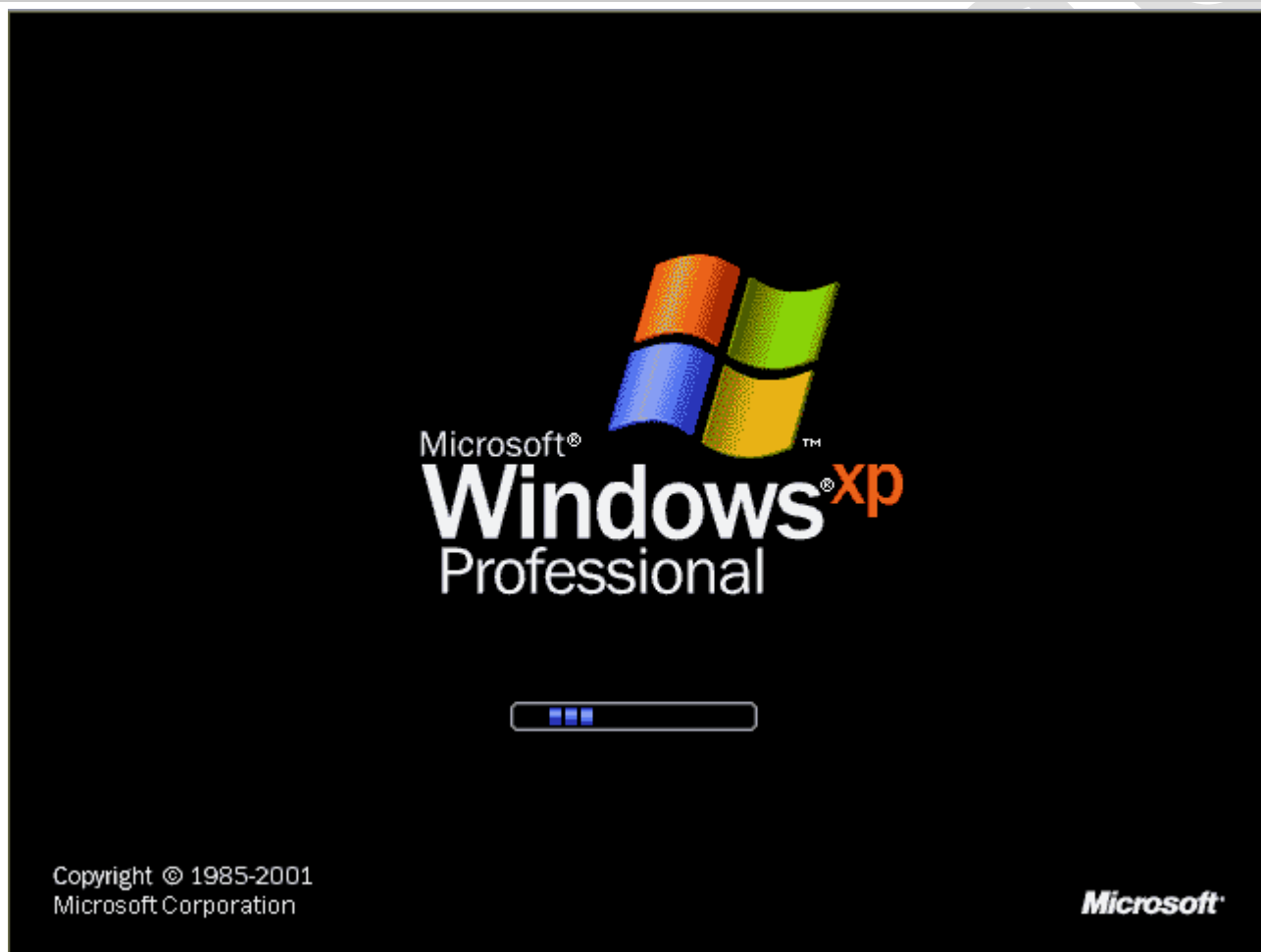
Analogue data have a slightly higher quality in their original form than digital data, but while being duplicated, the quality goes down. An example of analogue data is an VCR tape

Sona Adel

OPERATING SYSTEMS

An operating system (OS) is the first and most basic program installed onto a computer. Without the OS, the computer is essentially useless; therefore all computers must have an operating system to run. Most of the time a computer comes with an operating system already pre-loaded onto it. These are usually Windows developed by Microsoft, Macintosh developed by Apple, or UNIX. These mentioned above are not the only operating systems available. In fact, there are hundreds available for 'special purpose applications' (1) (robotics, mainframes, etc.).

The purpose of an operating system is to manage and control the hardware and software of the computer (memory, disk space, etc).



Boot

To put it in simple terms, 'to boot' basically means to start up your computer. The term originated from the idea that the computer has to lift itself up 'by its own bootstraps' to get going. Computers can perform two types of boots, 'cold boots' and 'warm boots'. A cold boot is when a computer is turned on from its total power-off status. So if your computer is turned off, and you power it up, you have just performed a cold boot. A warm boot, also known as a 're-boot', is when a computer is restarted by performing a reset operation (Ctrl-Alt-Del, etc) when a program freezes.

The operating system is the first piece of software loaded during the computer boot because it is crucial as it runs all other programs. During the boot the computer's random access memory (RAM) is recycled.

Multitasking

Multitasking is the ability of an operating system to run two or more programs at the same time. For example, when a computer user is opening an application, browsing a folder, or surfing the internet, they are using the operating system's multitasking ability.

Virus Scan Programs



Viruses... nasty! When you hear virus and computer in the same sentence, you know it can never be good. Thankfully most operating systems come with some form of virus prevention or detection. Virus scanners can also be installed for more protection. These virus scanners basically work by searching all the files, programs, and applications on your computer. What is it searching for? Well, it is looking for certain code patterns or signatures of known viruses. Once a virus is detected it is automatically deleted by the program.

Although these virus scanners are very helpful, they are not a complete solution. They only work with known viruses and thus they are only as powerful as their last update. Solution - update your virus scanning software regularly to decrease the chance of being infected.

Disk Format

There are two types of disk formatting, 'low-level' and 'high-level'. Low-level formatting, also known as 'true formatting', creates the actual spaces and structures on the surface of the storage media (hard disk or floppy disk) that will be used to hold the data. 'High-level formatting uses the structures created by the low-level formatting to prepare the disk to hold the actual files' (2).

Defragment

'When computer files are created or deleted, the free space on the computer is split up into small non-contiguous blocks.'(3) This means that when new files are created, they unfortunately cannot be stored next to each other on the disk. Instead, they are scattered along the disk, fitting into any of the free blocks they find. This causes the file to become 'fragmented'.

Having fragmented files on your computer is not a good thing. It can cause the computer to run slower and it increases the risk of having corrupt files. But by using the 'Disk Defragmenter' application, you can easily fix the problem of having fragmented files. To do this, the Disk Defragmenter rewrites the fragmented files so that they all fall into continuous blocks next to each other on the disk.

Resources:

1 <http://www.howstuffworks.com>

2 <http://www.pcguide.com/ref/fdd/mediaFormatting-c.html>

3 <http://www.ontrack.com/glossary>

RESPONSIBLE COMPUTER USE

Basics

Many people own their own computer, whether a desktop or laptop, and their number is increasing daily. Along with owning your own computer comes a responsibility. You should take care of the computer and make sure that the computer and your data stay in good condition. This can refer to back-ups, virus checking, security, storage, housekeeping, and more.



Backing Up Data

Firstly, when dealing with your data, you have to acknowledge the fact that it can be lost, damaged, or deleted. Because of this, computer owners must make back-ups of their data. Back-ups on a remote server, external hard-drive, or in various other locations can prove very helpful in the case of irretrievable data. Detailed information about back-ups and how to make them is found in the link at the top of the page.



Security and Viruses

Next, security is a large aspect of responsible computer use. You should always keep yourself and your data protected. Whether this protection is from hackers, viruses, worms, spyware, or so on, you should always keep these things in mind. Viruses can not only damage your computer, but can damage other computers in which yours is connected to. That is why it is important to routinely check for viruses using programs such as Norton AntiVirus, which contains a scan as a utility. There are many methods to increase your security and virus protection, and more information via the links above.

Storage

Responsible storage methods are important for a computer just as back-ups are. Firstly, it is important to have sufficient storage capacity for your files and data. This can be in the form of a hard-drive, flash-drive, external hard-drive, or storage server. Similarly, it is vital to not use up all the storage capacity you have on your computer's internal storage devices. This will slow down the computer and render it more susceptible to problems such as computer crashes and data corruption. For more information on storage check out the link at the top of the page.

Housekeeping



"When referring to computers, housekeeping is a term used to describe the optimization of a hard disk drive. Housekeeping commonly involves removing old or unused files, removing programs no longer being used, backing up data, and/or running disk utilities such as a scandisk, defrag, or a virus scan. Housekeeping is meant as a way to help keep the computer organized and running properly and should be performed at least once a year." -Computer Hope.com Accessed March 2007

This includes the cleanliness of the computer on the inside and out, the protection from power surges, battery replacements, disk defragmentation, and much more. Be sure to check out the helpful links for all the information you need.

Information on do's and don'ts of the computer and its maintenance.

Information on physical housekeeping of the computer.

Very detailed and resourceful instructions regarding computer housekeeping.

And finally, information on Mac Housekeeping.

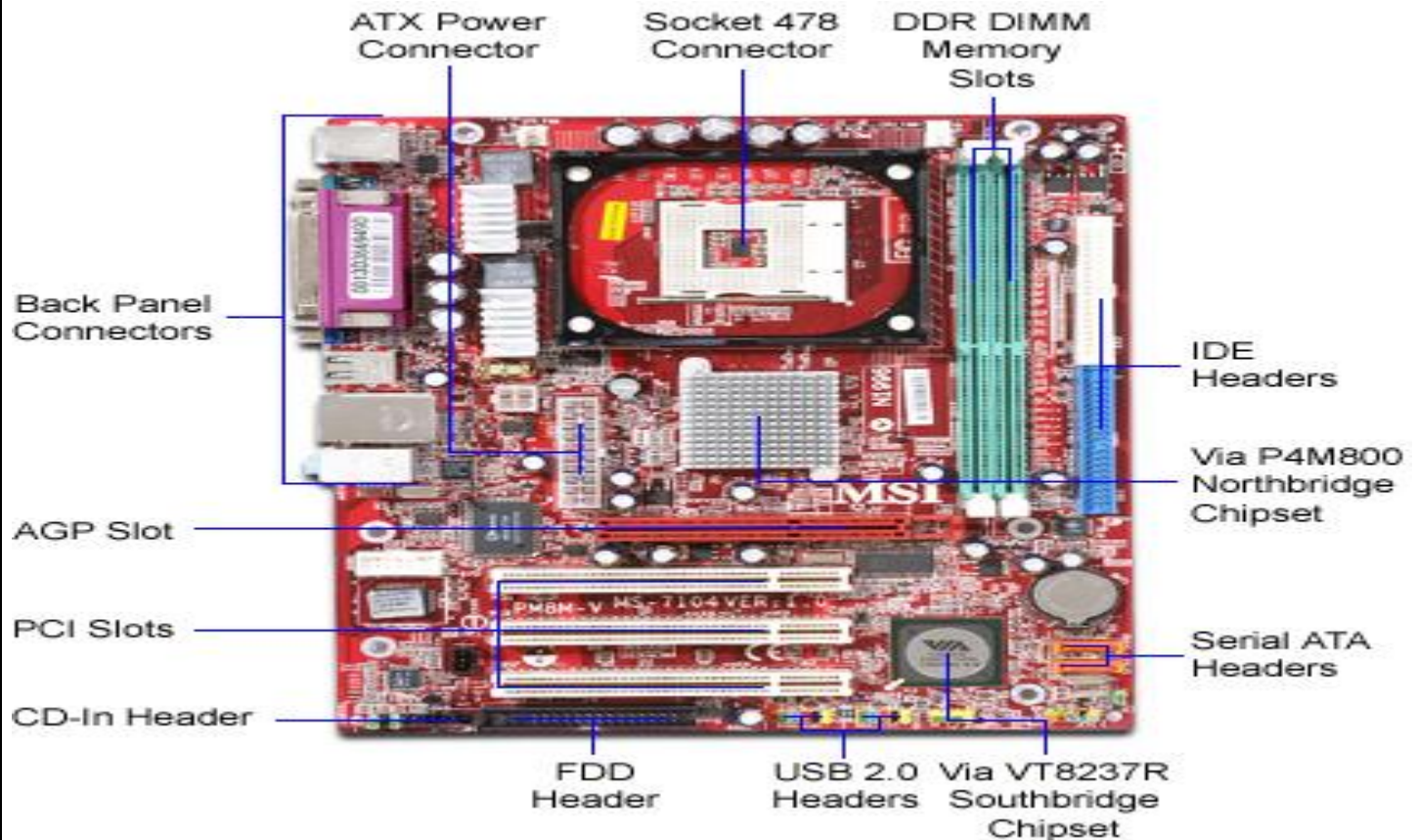
Other

For more information regarding responsible computer use, click here.

Other resources:

- **Computing News**
- **ES-Net**
- **ICT Hub Knowledgebase**

IMPLEMENTING OR UPGRADING IT SYSTEMS

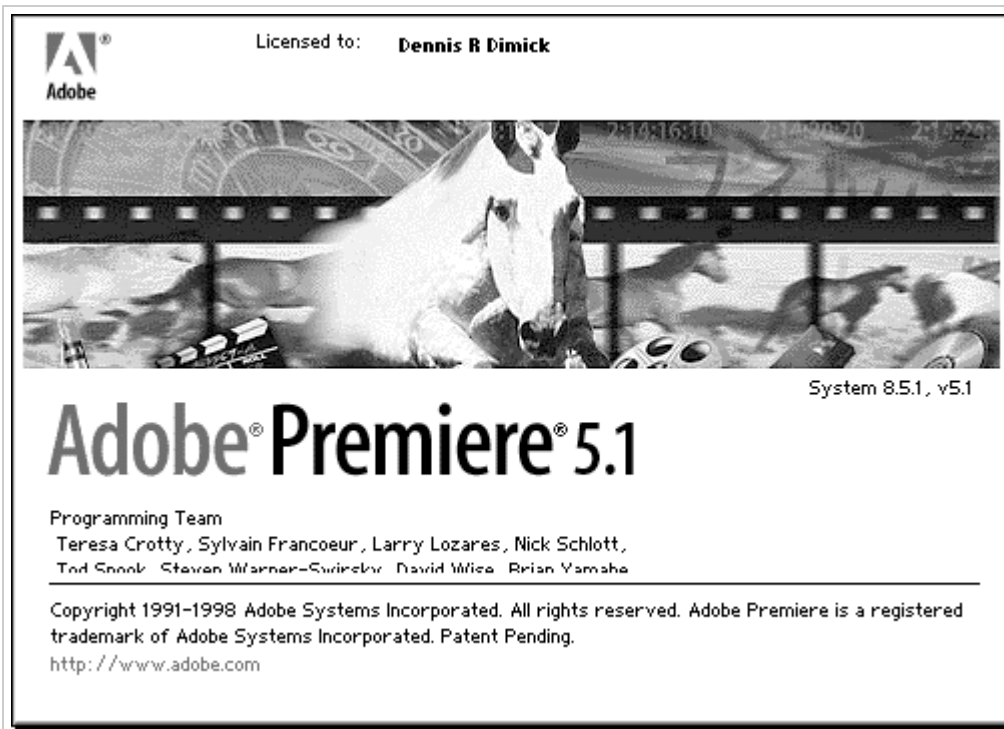


The first method that is commonly being used is the **upgrade of the hardware components** of the PC. As the PC systems are compatible with the newer hardware and as the technology becomes obsolete and is being replaced with the newer one, the systems could have their internal components exchanged to ensure the rise in performance and stability of the system.

Usually, in a standard PC, we are dealing with five serviceable components on the system board:

- The microprocessor
- The RAM modules
- The CMOS backup battery
- The ROM BIOS integrated circuit (IC)
- The cache memory

Those parts are usually mounted in the special sockets so the upgrading process is easier and more reliable. Some of the other ones include the change of hard drives, graphic cards and/or other internal components. This all has to be done if the user wants to be up to date with the newest innovations.



Another thing to consider is the **upgrade of software and applications**. Most software companies continually work to improve their products by removing bugs and adding new , special features. As the result, many versions of the software are upgraded sometimes on a monthly or yearly basis. To distinguish between versions, program names are generally followed by version numbers, such as 7.0 in Internet Explorer. Most companies use decimals to indicate minor revisions and whole numbers to indicate major revisions. For example, I know that Adobe Premiere 5.0 is a major upgrade (version) but a 5.1 or 5.2 would include some minor changes being implemented. That is why Adobe Premiere 6.0 will be significantly different from the older version 5.1. When you buy a software program you generally get the current version, but as the updates are released you can upgrade your software to the newer version by downloading the update from the internet or paying a fee to the software manufacturer and obtaining your copy.



Internet Explorer 7.0 is a good example of a major revision.

Computer System Analysis is as the name suggests dealing with the complex computer systems and analyzing their contents. It may include checking the overall status, the flow of data , the used space, the consolidation of data and many others.... Usually the analysis is performed if we want to make a change in a PC but we are unsure about the results. The analysis enables the easier prediction of what could happen and what is the current state of the system. The analysts could setup , upgrade and troubleshoot the customized software and databases.(For example the record of books due , in the library has to be analyzed and managed correctly in order for the system to function normally.

Software and computer testing is the process used to help identify the correctness, completeness, security, and quality of developed computer software.(Wikipedia.com/2007)